Atlantic salmon

Salmo salar

Status

Federal status: G5 N4N5, Distinct Population Segment - Gulf of Maine listed Endangered
NH state status: S4, Not listed
ME state status: S3, Not listed

Wild populations of North American stocks of Atlantic salmon have declined substantially over the last thirty years. In November of 2000, the Gulf of Maine Distinct Population Segment (DPS) of Atlantic salmon was federally listed as endangered. Remaining runs of wild salmon from the Gulf of Maine watersheds were estimated at 500 spawning adults in 1995, and dropped to less than 50 fish by 1999. These runs represent the last wild indigenous strains of Atlantic salmon within the United States. Catches of Atlantic salmon from the North Atlantic are estimated at 25% of catches taken in the 1960s, indicting a possible decline across its range.

The populations that occur in New Hampshire and most of Maine are a combination of native and non-native strains of hatchery-reared Atlantic salmon. Original stocks of Atlantic salmon indigenous to (i.e. naturally-occurring in) the Connecticut and Merrimack River basins have been extirpated since before 1900. The fish that have been stocked in these basins are from other locations, primarily river systems in Maine. The loss of almost all indigenous stocks from New England, and the intensive restoration efforts underway for the species in North America, indicate a viability concern. None of the viability outcomes (A-E) apply to a non-indigenous stock of a native species, so outcomes are not provided.

Distribution

Atlantic salmon range across the North Atlantic, south to Portugal in the east, and south to the Connecticut and Housatonic rivers in the west (possibly formerly to Delaware); north to northern Quebec and the eastern Hudson Bay. Landlocked strains of the species are widely stocked in lakes, but are seldom self-sustaining. Atlantic salmon are depleted or extirpated from the western and southern parts of their range (New England region), but based on state and international rankings are considered locally common and globally stable. It is believed that state rankings are based on the occurrence of non-indigenous hatchery-produced populations.

Historically, anadromous Atlantic salmon were present in large numbers in MA, ME, NH, and VT. They were historically found in the Connecticut and Merrimack River basins and were believed to travel into headwater areas within the White Mountain National Forest. They also occurred in the Androscoggin and Saco River basins but natural barriers probably prevented them from inhabiting waters on the National Forest.

Current restoration programs in the Connecticut and Merrimack River basins began in the 1970s. Several hydropower dams along these rivers prevent adult salmon from reaching historic spawning grounds. Young salmon from the Penobscot River in Maine were the predominant stock used to initiate the restoration programs.

Atlantic salmon on the National Forest are currently limited to young salmon stocked for restoration purposes. Annually, young fry are stocked in most 3rd order and larger streams with drainage into the Connecticut and Merrimack River watersheds, including many streams on the WMNF. After spending an average of two winters in freshwater streams, young salmon migrate downstream.

Adult returns from individual stocking-years have not met expectations, ranging from 0 to 294 fish in the Connecticut and from 2 to 278 fish in the Merrimack over the last thirty years. Estimates of average numbers of yearling parr per unit of rearing habitat within the Merrimack basin have ranged from 0 to 4.9. These estimates are lower than some of the Gulf of Maine rivers, but fry-to-yearling parr survival is not considered poor.

One Atlantic salmon parr not related to restoration stocking programs was found on the WMNF in 1999 in Great Brook, ME, during a Forest Service fish population survey. It is believed to be a product of a landlocked population in Kezar Lake (maintained by a hatchery program) that ascends Great Brook during spawning periods.

Habitat

The complex life cycle of the salmon requires spawning and rearing habitat in freshwater streams, migratory habitat in large rivers, coastal estuary environments where salmon smolts adapt from freshwater to saltwater life, and finally North Atlantic ocean environments where salmon spend most of their adult life.

For spawning, salmon require streams with sufficient stretches of coarse, clean gravel for building nests and laying eggs. Gravel stretches are often 2-3 meters long and more than one meter wide. Water in spawning areas is swift with depths of 30-60 cm. Streams must have adequate cover, and food supply to sustain young salmon through the first two, sometimes three, years of life. Young salmon prefer riffle habitats, feeding on both aquatic and terrestrial invertebrates while using cobbles and boulders for protective cover.

Salmon smolts generally migrate from the river to the sea between April and June. Most New England smolts enter the sea in May and June to begin their ocean migration. Seasonal water flow, seasonal water temperatures, and barriers to migration are important habitat variables for the downstream and upstream migration phases of the life cycle.

Limiting Factors

Dam construction, water pollution, and overexploitation over 100 years ago devastated Atlantic salmon populations in New England. In the 1970s and 1980s, recreational fishing and commercial at-sea fisheries contributed to the more recent reduction of the salmon population, even after major restoration projects were underway.

All North American stocks of salmon have experienced drastic declines in recent decades. For this reason, it is believed that major factors controlling wild salmon abundance are tied to the marine phase of the life cycle. International commercial fisheries of salmon and its prey, climatic changes that have changed upper surface water temperatures thereby potentially altering food chain dynamics, acid deposition impacts in poorly buffered watersheds, and interbreeding with and diseases from domestic pen-raised salmon, have contributed to the worldwide decline in salmon catches observed over the last twenty years.

Non-marine factors may also be affecting adult returns from salmon restoration programs. However the complexity of the life cycle makes it difficult to determine the impact any one factor may have in a given year or over the length of the restoration program.

Most of the young salmon used in these restoration programs originate from the Penobscot River stocks in Maine. The loss of local adaptations from original stocks may contribute to low return rates. Some research indicates that the salmon and trout family is capable of local adaptation given a reasonable number of generations.

Fish passage through existing dams continues to be one of the largest challenges facing salmon restoration. Major efforts have been underway in recent decades to create facilities allowing highly efficient fish passage through critical waterways, and improvements are continually being made as studies provide new insight. Recent improvements to passage facilities at one dam increased survival of study smolts to over 90%.

Smolts may require more time to negotiate downstream through impounded dam environments and through passage facilities. This could extend the migration period into warmer times of the year, reducing smolt condition as they enter the ocean. Salmon population declines have been most drastic in the southern extremes of its range, suggesting that global warming may be at work, perhaps compounded by the presence of dams.

Dams also may create predator staging areas. Striped bass have recovered to historical levels along the East Coast from low numbers in the mid-1980s. Studies have shown that in some years predation of smolts by striped bass is quite high below dams. In other years, predation on smolts appeared to be low when bass apparently focused on shad and herring young. Some believe the restoration of these other prey species is needed to reduce the predation rates of salmon smolts.

Erosion, sedimentation, and water pollution were once large in-basin factors that contributed to the demise of indigenous stocks of salmon. These factors certainly could influence survival of stocked salmon and migrating smolts if they were occurring at watershed scales. Current laws and mitigation measures in place control the magnitude of localized erosion and sedimentation. The impacts of acid deposition on soils and water may have long-term impacts to water quality.

Viability concern

There are no viable populations of this species remaining in New England. The only indigenous stocks are federally listed as endangered. The loss of almost all indigenous stocks from New England, and the intensive restoration efforts underway for the species in North American waters, indicate a viability concern. Atlantic salmon fry have been stocked for many years on the WMNF as part of the restoration effort. Although none have returned to the Forest due to low adult returns and impassable dams downstream, the Forest is still considered an important part of the restoration effort.

Management activities that might affect viability

Activities that increase sedimentation, increase water temperatures, or reduce mid-summer or mid-winter stream flows could affect habitat suitability for young salmon.

Young salmon have a higher tolerance for sediment than eggs, and salmon are not spawning on the WMNF currently, so what levels of sedimentation could pose a threat is uncertain but would probably have to be moderate to high. Road and trail construction, logging, and recreational use can increase both temperature and sediment levels if the activity is adjacent to or in direct line with a stream. Mitigation measures that restrict levels of disturbance at both spatial and temporal landscape scales provide the best protection against raising water temperatures, increasing instream sediment levels, and reducing stream flows.

The major factors believed to be preventing successful Atlantic salmon restoration occur off the WMNF. Local experts believe that management activities implemented under the current WMNF management plan do not contribute to the viability challenges facing restoration of salmon stocks to either the Connecticut or Merrimack River basins.

References

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